

**REMARKS<sup>1</sup>**

In the outstanding Office Action, the Examiner rejected claims 1-13 under 35 U.S.C. § 112, second paragraph.

By this amendment, Applicants have amended claims 1, 3, 5, and 12. Claims 1-13 remain pending in this application.

Applicants initially note that the Examiner did not reject any of claims 1-13 as being anticipated by, or obvious in view of, any prior art. Accordingly, Applicants assume that but for the 35 U.S.C. § 112 second paragraph issues, claims 1-13 are otherwise allowable. *See* MPEP § 2173.06 8th Ed., Rev. 6 (Sept. 2007). Moreover, Applicants note that the amendments made to claims 1, 3, 5, and 12 are in response to the Examiner's rejection under 35 U.S.C. § 112, second paragraph, and thus are rejections which may include limitations which should have been reasonably expected to have been claimed. Accordingly, any new grounds of rejection made by the Examiner in a subsequent Office Action would *not* have been necessitated by the present amendment, and such a rejection may not be made final. *Id.*, at § 706.07(a).

Regarding the rejection of claims 1-13 under 35 U.S.C. § 112, second paragraph, the Examiner asserts that the claims include recitations which are unclear and indefinite. Applicants disagree. Nevertheless, in an attempt to expedite prosecution, Applicants have amended claims 1, 3, 5, and 12 to improve clarity and address the Examiner's concerns, as discussed below.

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<sup>1</sup> The Office Action contains statements reflecting characterizations of the related art and the claims. Regardless of whether any such statement is identified herein, Applicants decline to automatically subscribe to any statement or characterization in the Office Action.

With respect to claim 1, Applicants will explain some of the terms recited therein with reference to Example 1 described in Applicants' specification at, for example, page 38, line 25 - page 53, line 26, and FIGS. 9-15. As described therein, each ion among a plurality of ions may be an example of "a physical system," and a collection of the plurality of ions may be an example of "ensemble." Thus, "a physical system" may be exemplified, for example, by "a  $\text{Pr}^{3+}$  ion", as discussed in Example 1. Similarly, an example of "an ensemble" may be, for example, " $\text{Pr}^{3+}$  ions dispersed in a  $\text{Y}_2\text{SiO}_5$  crystal", as also discussed in Example 1, and an example of "n numbers of ensembles" may be, for example, "crystals 5 to 8", as discussed in Example 1 (see, for example, FIG. 9). However, these are merely examples, and are not intended to limit Applicants' claimed embodiments.

With respect to the Examiner's assertion that "[t]he physical system would not have energy levels unless it is irradiated with pulsed light" (Office Action, page 3), Applicants note that the claimed "at least one physical system" may have "at least three energy levels including a first level, a second level and a third level in ascending order." The claimed "at least three energy levels" may be considered intrinsic to the claimed "physical system," and do not necessarily occur when the claimed "physical system" is irradiated with light. Moreover, with respect to the Examiner's assertion that "it is unclear as to how claimed angular frequencies are generated" (*Id.*), Applicants further note that the claimed "angular frequency" corresponding to an energy level, i.e.,  $\omega_1$ , may be expressed by energy and the Planck constant (i.e.,  $\Delta E = \hbar \omega_1$ ), and therefore is proportional to the energy differences between claimed "energy levels."

With respect to the Examiner's assertion that "Applicant must clearly set forth the photon transmission by consecutive labeling first, second, third, fourth, etc. for each ensemble" (Office Action, page 3), Applicants respectfully disagree. Consistent with some embodiments of the present invention, an example of the "quantum communication apparatus" of claim 1 may perform quantum communication using, for example, first and second photons emitted from the "physical systems" contained in the respective  $n$  ensembles. Thus, it is not necessary to describe other photons with respect to such embodiments.

Regarding the Examiner's assertion that "[i]n claims 4 and 13, it is unclear as to what does applicant meant [sic] by the phrase 'the angular frequency  $\omega_3$  being used as the coherent pulsed light of the angular frequency  $\omega_1$  and the coherent pulsed light of the angular frequency  $\omega_2$ ,'" (Office Action, page 3), Applicants will provide an exemplary explanation of claims 4 and 13. Claims 1 and 12 recite a combination including "coherent pulsed light of an angular frequency  $\omega_1$ " and "coherent pulsed light of an angular frequency  $\omega_2$ ". Claim 3 recites a combination including "two light sources" for emitting light of angular frequency  $\omega_1$  and angular frequency  $\omega_2$ . On the other hand, claims 4 and 13 recite a combination including wherein "the angular frequency  $\omega_3$  being used as the coherent pulsed light of the angular frequency  $\omega_1$  and the coherent pulsed light of the angular frequency  $\omega_2$ ." That is, in some embodiments of the present invention, a single light source may be used for emitting light at "angular frequency  $\omega_3$ ", which may be equal to "angular frequency  $\omega_1$ " and "angular frequency  $\omega_2$ ." See, e.g.,

Applicants' specification at, for example, page 55, line 23 - page 57, line 23.

Accordingly, Applicants disagree with the Examiner's assertions with respect to claims 4 and 13, and submit that claims 4 and 13 comply with 35 U.S.C. § 112, second paragraph.

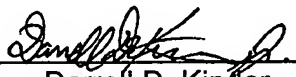
In view of the foregoing amendments and remarks, Applicants submit that claims 1-13 comply with 35 U.S.C. § 112, second paragraph. Accordingly, Applicants respectfully request that the Examiner withdraw the rejection of claims 1-13 under 35 U.S.C. § 112, second paragraph. Moreover, Applicants respectfully request reconsideration and reexamination of this application and the timely allowance of the pending claims.

Please grant any additional extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

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